PROGRESS REPORTS

FROM

EXPERIMENT STATIONS

SEASON 1952-53

NORTHERN NIGERIA

PUBLISHED BY
THE EMPIRE COTTON GROWING CORPORATION
12 CHANTREY HOUSE, ECCLESTON STREET,
LONDON, S.W.1.

1954

COMMONWEALTH MYCOLOGICAL INSTITUTE
18 AUG 1954

The price of this Progress Report and of the other Progress Reports issued and to be issued for the 1952-53 season is 9d. each, post free. The price of the full set of Reports for the 1952-53 season (approximately 12 Reports, despatched as published) is 7s. 6d., post free. Reports for the 1951-52 season are available either separately or in sets, at the same prices.

Other Progress Reports are available (in seasonal volumes only) at the prices shown below. Volumes not listed are out of print.

1923-25 (one volume)	2s.
1926-27, 1931-32, 1934-35, 1935-36 ...	2s. 6d. each.
1942-43, 1945-46, 1946-47, 1947-48, 1948-49, 1949-50, 1950-51	3s. 0d. each.

NORTHERN NIGERIA

PROGRESS REPORT FOR THE SEASON 1952-53

Planting Period: June to August.
Picking Period: November to February.
Close Season: April to June.
Rainfall at Samaru, March-October, 1952: 43·51 inches.
Rainfall Average, 1924 to 1951 : 43·32 inches.

GENERAL INTRODUCTION

BY

H. E. KING.

Season.

Following the previous season's record yield of 113,510 bales, there was a further marked increase in the demand for seed and 17% more was issued. Not all this was planted, however, and some, taken by inexperienced cultivators, gave very little return. In addition the early rains over parts of the cotton growing area were unfavourable for the establishment of food crops and threw the cotton planting unduly late.

Elsewhere, the confidence induced by the easily obtained good yields of the previous crop led to less attention to timely planting and weeding.

In consequence the crop for export reached only 95,445 bales (90,124 of Allen and 5,321 of Benue ungraded) and the average return per ton of seed issued fell from 10 to 7 bales of lint. Of the Allen total about 63% was Samaru 26C, but mostly "First Wave" impure seed.

At Samaru, in Zaria Province generally and in some other areas, however, yields were as good as in the 1951-52 season, while at Gombe (in Bauchi Province) an extremely good crop was obtained. The growth of the cotton growing industry in the Gombe area has been phenomenal and it is clearly capable of further expansion. First steps in establishing a subsidiary seed multiplication scheme there were carried through successfully but great difficulty was found in keeping the produce of the pure seed issue separate from the general crop in marketing.

Yields in Southern Katsina, which comprises the main seed multiplication scheme based on Daudawa, were well below those of the previous season, but sufficient seed of Samaru 26C was obtained to complete the programme of replacing the old stocks of Allen type

throughout the remainder of the Allen zone for the 1953-54 season's planting.

Rainfall at Samaru was unusually heavy for the first few weeks after planting (in July), well below average in August and about normal in total and in time of cessation (early October).

The growth of the crop was in general satisfactory. Insect damage (dealt with in detail in a later section) was on the whole not unduly severe. That attributed to mirids (*Campylomma* and/or *Lygus spp.*) was less than in the two previous seasons.

Bacterial blight (*Xanthomonas malvacearum*), however, was definitely more in evidence than in 1950-51 or 1951-52. How much reduction in yield of cotton in N. Nigeria can be attributed to this disease in its several manifestations (angular leaf spot, vein blight, blackarm and bacterial boll rot) is not yet clear but it seems probable that it can in some seasons be responsible for much damage to bolls. At the same time differences between strains in the severity of symptoms displayed (in some cases related to known presence or absence of resistance genes) are not related obviously to differences in yield. MU8A, a known susceptible type, fairly consistently outyields some strains of known high resistance. Seasonal variations in the magnitude of the advantage shown by one strain over another have not yet been sufficiently accurately determined, but MU8A did in fact this season give a smaller increase over 26C than in previous trials.

The heavier incidence of this disease this season enabled clear differences to be detected by field observation between selections from Samaru 26C believed in previous seasons to be all satisfactorily resistant. One in particular, 4998-14, which had a good record for yield and other characters and which had been a contributor to the new mixture known as "Select Progeny Bulk" made up last season, was clearly not good enough under the more severe conditions. It stood out beyond doubt in some plots as susceptible to heavy leaf damage and elsewhere (including some of the district variety tests) it could be detected by careful examination as inferior in resistance.

Staff, Buildings and Land.

Mr. King took leave in the United Kingdom between July 8th and October 2nd 1953. Mr. M. A. Choyce arrived on first appointment on 18th August 1952. Mr J. H. Saunders proceeded on leave on 13th March 1953.

Two additional African Agricultural Assistants were posted, one for breeding work and one for entomology, near the end of the season.

The installation of the power driven saw gin and a linter gin was completed in March 1953. (This machinery was ordered in June 1950 and in the interval only a hand gin was available at Samaru).

An additional eight acres of land was cleared for cropping.

PLANT BREEDING

BY

H. E. KING.

Replicated Progeny Row Tests.

Two replicated progeny row trials were conducted, one including 49 single plant selections derived from 26C, and the other 64 selections from various Allen stocks. Some 37 in all were considered worth carrying forward, six of these being of particular promise, combining good yield with apparently satisfactory lint quality.

Inheritance of Resistance to Leaf Tattering.

A replicated experiment, comparing plants raised from seed collected from more and less tattered parent plants within a 26C sub-strain, gave an encouraging result. Scored for severity of leaf tattering by three observers independently a small but clearly significant difference was found, the plants from less tattered parents showing less damage on average.

This tattering, ascribed to mirids of which *Campylomma* is by far the most frequent here, is most erratic in its incidence and plant to plant differences have not yet been related to any characteristic of the plant. Differences in susceptibility between strains such as MU8 and 26C had already been noted.

District Variety Tests.

The series of eight district variety tests, one at Samaru and seven at other stations run by the field staff of the Agricultural Department, represents perhaps the most immediately important and interesting part of the season's work. The yields are presented in Table 1, the actual weight of seed cotton in lb. per acre being given for the "control" type (Samaru-grown New Nucleus Stock of 26C) and the yields of the other strains expressed as a percentage of this.

All strains represent material derived from 26C stock and of 26C general character but the majority (and in particular selections 479-25 and 49160-23) are of distinctly better lint quality. All had shown good yields in Samaru tests in previous seasons. In studying the figures of Table 1 it should be remembered that the "control" is the New Nucleus Stock whose yield is higher than that of older stocks of 26C (see Seed Stocks Trial, later). No commercial bulk 26C or Allen was included in these tests. It may be taken that a selection giving an advance on New Nucleus Stock is substantially heavier yielding than the older stocks.

TABLE 1.

DISTRICT VARIETY TESTS OF 26C DERIVATIVES, 1952-53.
SEED COTTON YIELDS FROM EIGHT EXPERIMENTS GROUPED.

Locality with yield of 26C New Nucleus Stock in lb. per acre.	*Yields expressed as percentage of 26C New Nucleus Stock.*							*S.E. %*
	479-25	49160-23	*Select Progeny Bulk*	4998-14	49113-18	4717-BSD	4744-BSD	
Group I. Localities within Main Cotton Belt.								
Samaru 824	103	103	96	103	103	99	91	2·9
Daudawa 515	114	105	114	109	110	101	103	5·4
Gusau 735	103	106	100	104	102	97	98	3·4
Group Average —	107	105	104	105	105	99	97	
Group II. Eastern and North Eastern Areas.								
Gombe 459	110	97	105	104	106	104	107	4·0
Maiduguri 767	109	91	105	115	101	106	106	3·7
Group III. Northern Fringe of Cotton Belt.								
Kano 251	109	116	105	100	106	105	95	5·8
Group IV. Southern Fringe (Longer rainy season).								
Kontagora 116	121	122	102	88	111	88	85	10·5
Zonkwa 130	104	115	104	96	77	91	90	8·4
Overall Average for Eight Experiments.	109	107	104	102	102	99	97	

Planting dates were all between the 2nd and the 11th of July, except for Maiduguri and Zonkwa. Both these were planted on 15th July.

It is apparent from the results over the whole eight localities that strains 479-25 and 49160-23 are promising. There is however evidence of interaction of strain with locality, and selection 49160-23 has done relatively poorly at Maiduguri and Gombe while both it and selection 479-25 failed to show a convincing advance over control at Samaru and Gusau. These are two sites where the overall yields were high and conditions favourable for all strains to give good results. The figures for Kontagora and Zonkwa, where conditions were less favourable, are in marked contrast. It would appear that selections 479-25 and 49160-23 are more tolerant of poor conditions. This may be connected with their earlier cropping characteristic; both give a bigger proportion of their total yield in the early pickings.

The yields at Samaru, Daudawa and Gusau *with the final picking omitted,* are given in Table 2.

TABLE 2.

MAIN COTTON BELT DISTRICT VARIETY TESTS.
SEED COTTON YIELDS, OMITTING LATE PICKINGS.

Locality.	*26C lb. per acre.*	*479-25 as % 26C.*	*49160-23 as % 26C.*
Samaru	602	116	109
Daudawa	301	120	120
Gusau	652	106	111

The additional advantage of earliness is well brought out by these figures. Its value in the event of late planting is being tested in the coming season.

The figures given above are all of seed cotton yields. Ginning percentages for the different strains in different localities varied rather widely and were somewhat inconsistent. On average, both 49160-23 and 479-25 fell below the high standard of New Nucleus Stock, 49160-23 by about 1% and 479-25 by about 2·5%. The latter, therefore, in terms of *lint yield,* averaged little more than 1% increase over control, but the former remained more than 3% superior. Both strains are being subjected to intensive reselection to improve this character. As both are at present very definitely above 26C in spinning quality some slight drop in quality can be risked in this proeess.

Supplementary Variety Test.

An interesting comparison of a range of types other than 26C was made in a separate replicated experiment at Samaru.

As the types which it was desired to include covered a wide range of plant habit and vigour, 3-row plots were employed and the yields of the central row were recorded separately. This has provided data from which it is hoped to be able to study the effect of competition between diverse strains. This study is not yet completed but it appears that competition has depressed the yields of the outside rows of the two strains of weakest vegetative growth in comparison with the yield of the central row. This effect is not at all large, however, and apart from these two strains (the two subtypes of MU8A) comparisons based on the total yields of all three ridges appear quite sound. It is these yields which are given in Table 3.

Growth was good and yields high, with very marked differences between some of the types. The experiment was sown on 7th July as a balanced incomplete block design with 15 strains in 7 fold replication (plot area 1/150 acre, spacing 18 inches on 3 foot ridges).

The yields given by the BAR D28 selections are noteworthy. Type D28 originated in the Northern Gold Coast and under selection at Shambat yielded a progeny homozygous for a high degree of resistance to blackarm.

Grown at Samaru in 1949-50 this progeny was found to crop well and to be "splitting" for earliness of cropping and lint length although predominantly late and of poor length. The five selections included in this test have all given a distinctly higher seed cotton yield than the 26C control though only the three highest are significantly better. As with almost all types introduced for trial against 26C, however, a considerable part of the advantage in yield is lost when ginning percentage is taken into account. This material remains promising, however, in so far as it is responding to selection for higher ginning percentage and increased lint length and has given selections no later in cropping than 26C.

TABLE 3.

DATA FROM SUPPLEMENTARY VARIETY TEST.

Strain	Seed Cotton		Gin	Lint		Earliness (1)	Lint length
	lb. p. ac.	%	%	lb. p. ac.	%		mm.
26C Nucleus Stock ...	685	100	35·7	245	100	65	35·5
MU8A Barberton Stock	747	109	31·3	234	96	85	31·0
MU8A Treble B.C.P. (2) ...	755	110	32·1	242	99	77	31·9
BAR 17/1 On-type bulk	632	92	30·9	195	80	66	35·2
BAR 17/1 Off-type bulk	654	95	31·6	207	85	69	34·6
BAR D28 — B.C.P ...	786	115	30·3	238	97	50	34·2
,, ,, — 4	818	119	32·5	266	109	54	35·3
,, ,, — 11	903	132	31·9	288	118	59	32·8
,, ,, — 13	765	112	30·2	231	94	65	34·6
,, ,, — 14	849	124	30·4	258	105	46	35·0
,, ,, — 15	784	115	32·6	256	105	57	34·6
Sokoto Local (*G. hirsutum*)	691	101	31·8	220	90	63	33·6
Okene Local (predominantly *G. barbadense*)	390	57	32·8	128	52	20	31·8
Ishan (*G. barbadense*) ...	544	80	34·5	188	77	10	34·7
BAR 4/16 (*G. barbadense*)	393	57	32·2	127	52	52	39·8
S.E. ...	38	5·6					

(1) Earliness of Cropping, viz. weight of crop produced by 31st December expressed as percentage of total crop. Picking continued until 18th February.

(2) B.C.P. stands for Bulking of Chosen Plants.

The difference between the two sub-types of MU8A is of interest. The "Treble B.C.P." represents the result of selecting and bulking chosen plants and repeating the process over three generations. The result has been a slight improvement in ginning percentage and lint length with negligible change in seed cotton yield and some loss of earliness. It appears that there is no likelihood of producing a change of worthwhile magnitude by this means.

Seed Stocks Trial.

Eight seed stocks were tested in replicated experiments at Samaru and Daudawa. The results of the two tests are given in Table 4. One stock of Allen was included, obtained from Mai Inchi ginnery area.

This was thought likely to be more nearly representative of the old unimproved Allen than the stocks used for trials in recent seasons. The results obtained with this Mai Inchi seed confirm the belief that the smaller differences obtained between Allen and 26C in 1949-50 and 1950-51 were due to the Zaria and Funtua Allen stocks then used having been appreciably "graded up" by admixture with early issues of 26C and its predecessors.

The figures for ginning percentage of the first wave 26C suggest strongly that this seed, which has gone through five seasons of multiplication since issue from Samaru, has suffered considerable contamination with Allen. The second, third and fourth wave stocks appear to represent 26C relatively free from adulteration or contamination, although there is a small progressive drop in ginning percentage with each extra season of multiplication. Fifth wave 26C, the produce of one season's multiplication at Daudawa of the New Nucleus Stock issued in 1951, differs little in yield from earlier issues but the same stock grown on at Samaru for a further season has given a distinctly higher lint yield.

TABLE 4.

YIELDS OF SEED STOCKS TRIALS AT SAMARU AND DAUDAWA, 1952-53.

Seed Stock	*Samaru*			*Daudawa*			*Mean Lint Yield*
	SC	*Gin %*	*Lint*	*SC*	*Gin %*	*Lint*	
Allen ex Mai Inchi	517	31·5	163 (100)	381	32·1	122 (100)	(100)
1st Wave 26C ex Stage F	543	33·1	180 (110)	382	33·8	129 (106)	(108)
2nd Wave 26C ex Stage E	571	34·0	194 (119)	449	34·7	156 (128)	(123)
3rd Wave 26C ex Stage D	596	34·7	207 (127)	396	35·1	139 (114)	(121)
4th Wave 26C ex Stage C	591	34·7	205 (126)	370	35·5	131 (107)	(118)
5th Wave 26C ex Stage B	571	35·2	201 (123)	406	35·7	145 (119)	(121)
New Nucleus Stock ex Samaru	615	35·7	220 (136)	438	35·6	156 (128)	(132)
Select Progeny Bulk	585	34·9	204 (125)	423	34·9	148 (121)	(124)
S.E.	20·3		6·9 (4·3)	21·1		7·3 (6·0)	(3·5)

Seed cotton and lint yields are given in lb. per acre and (in brackets) as percentage of yield of Allen.

It is very clear that, as was only to be expected, the earliest issues of 26C stock are now inferior in yielding power to the more recent stocks and that the "New Nucleus Stock" is an advance on the "4th Wave".

The performance of "Select Progeny Bulk" is disappointing. Made up by bulking seed from ten chosen substrains, on average better in yield as well as lint quality, it has shown no improvement over New Nucleus Stock in yield and an inferior ginning percentage. It appeared also in the District Variety Tests (see earlier) where it did rather better. Its behaviour is being tested against that of its components in a small scale test in the coming season, but it is not intended to carry it forward as a new stock.

Spinning Test Results.

Reports on samples from the 1951-52 experiments, sent to the Shirley Institute for testing, have confirmed previous indications that there is wide variation in spinning quality within Samaru 26C material. In general the better spinning selections have lower ginning percentages but several of high seed cotton yield have shown a distinct advance on 26C control samples in yarn strength and fineness.

The strain 49160-23 referred to under District Variety Tests (above), which was already known from a previous test to be of promising quality, gave a yarn strength figure (corrected count by strength product at 40's) 18% above that of 26C.

New Nucleus Stock showed a small advance on older 26C stocks, as expected, while a representative of 26C/479 derivation (see District Variety Tests) gave higher yarn strength and was of very definitely lower standard hair weight.

Agronomic and Fertiliser Experiments*.

With the co-operation of the Agronomist, Samaru, and the Senior Agricultural Officer, Daudawa, experiments were carried out at both places to test the interaction of planting date with level of soil fertility and with spacing. They are being repeated for a number of years to sample a range of seasonal conditions. The results in 1952-53 gave the commonly experienced planting date effect—a very marked fall in yields with delayed planting—at both places. This effect appeared at both levels of fertility and was uninfluenced by a wide variation in spacing. There was no interaction of spacing with fertility level. Records of the severity of mirid damage on the different treatments of this experiment are referred to later (page 13).

*Summarised from contributions of the Agronomy and Chemistry Sections, Samaru, to the Annual Report of the Northern Research Station of the Department of Agriculture, Nigeria.

A number of experiments, in which cotton appears as one of the crops, are being carried out at Samaru on type and length of rotation and on rotation of crops versus monocropping with various manurial treatments. These have now been running for four years and are beginning to give some interesting figures.

A reduction in yields under monocropping has already appeared with groundnuts and guineacorn at all levels of manuring, and with cotton when unmanured or given only one ton of FYM per annum. With annual dressings of 3 or 5 tons of FYM, however, cotton in monoculture has outyielded cotton in a rotation of cotton—guineacorn —groundnuts. The response of cotton to one ton of FYM is marked and the additional response to a further two tons is large but five tons per acre per annum have given only a small improvement over three.

Fuller details of these experiments will be given when they have been carried further.

Fertilizer trials on cotton have been confined this season to a single test of the effect of superphosphate with two application times. The results were not in keeping with the marked response obtained in some earlier experiments, the increase with fertiliser being only 38 lb. of seed cotton per acre. A range of experiments calculated to determine more clearly the conditions under which phosphatic manuring is profitable have since been commenced. It is probable that the level of available nitrogen affects the response to phosphate.

Received January 1954.

ENTOMOLOGY

BY

M. A. CHOYCE.

Introduction.

Routine records on the incidence of pests and the causes of crop loss were continued on standard observation plots at Daudawa, Gusau, Kontagora and Yola. At Gombe similar records were taken for the first time. At Samaru observations were made on the Botanist's rotation plots as in previous years. These records reveal that red bollworm populations were lower than those reported last year, except at Kontagora and Yola. Pink bollworm attack was notably higher than elsewhere at Yola and Gombe.

Studies on the pupal periods of the red bollworm, and on the emergence and diapause of the pink bollworm, are being continued. Emergences from red bollworms set during the 1951-52 season were

disappointing, and no firm conclusions can be drawn from them. Records of pink bollworm pupation and emergence confirm the findings given in the 1950-51 Progress Report.

Numerous samples of seed cotton and cotton seed from the ginneries in the Northern Region were examined, and these again revealed a predominantly low infestation of pink bollworm.

Two insecticide trials were held during the season. At Samaru good control of the mirid *Campylomma* was achieved, together with a marked reduction in leaf tattering. The precise effect on yield was obscured by the wide variation in fertility between the plots in the experimental area. At Daudawa the best insecticide treatment resulted in an increase of 50% in the yield of clean seed cotton, compared with the control.

Insect Pests.

Red Bollworm, Diparopsis perditor.

Details of red bollworm activity during the season are given in Table 5.

Table 5.

Diparopsis perditor. Egg and Larval Population, 1952-53.
(Figures for 1951-52 in parenthesis.)

Station	*Eggs per plant*	*Egg count peak/acre*	*Larval peak/acre*
Samaru (Botanist)	4·8 (13·9)	18,290 (34,920)	1,480 (2,290)
Samaru (Insecticide)*	1·5	3,570	1,970
Daudawa Standard	2·8 (9·3)	5,400 (20,760)	1,620 (3,360)
,, (Insecticide)*	2·2	10,760	2,340
Kontagora Standard	20·3 (10·7)	57,210 (18,350)	5,630 (2,680)
Gusau ,,	3·5 (4·6)	7,260 (9,190)	2,830 (6,600)
Yola ,,	6·0 (0·9)	15,240 (6,400)	4,180 (2,720)
Gombe ,,	4·5	9,750	1,553

*Refers to observations on the control plots of the Samaru Insecticide Trial from 7/9/52 to 31/1/53 and Daudawa Insecticide Trial from 26/10/52 to 31/1/53.

At Samaru the attack was less than that recorded last year, both in duration and in numbers of larvae in the crop. Only at Yola and Kontagora was the incidence recorded as being higher than last year. At Kontagora egg laying was particularly heavy and prolonged, and the last larva was found in the crop at the end of January.

Emergences of adults from long-term pupae of *Diparopsis* set during the 1951-52 season were too few to draw any definite conclusions. Further settings of larvae were made during the 1952-53 season, and at Samaru pupae are also being observed under laboratory conditions. Details of emergences from these will not be available until later this year.

Pink Bollworm, Platyedra gossypiella.

Table 6 shows the peak populations of pink bollworm found in green and split boll samples, together with the number of larvae per 1000 split bolls taken from all pickings of the crop.

TABLE 6.

PINK BOLLWORM POPULATIONS IN GREEN AND RIPE BOLL SAMPLES, 1952-53. (Figures for 1951-52 in parenthesis.)

	Peak population per acre in		*No. of larvae per 1000 split bolls*
	Green bolls	*Split bolls*	
Samaru (Botanist Rotation)	830 (6,060)	300 (1,020)	19·6
Daudawa Standard	810	120	5·4
Kontagora ,,	1,110 (890)	120	5·3
Gusau ,,	710 (25,130)	760 (4,260)	24·2
Gusau Peasants	—	—	30·3
Yola Standard	11,680 (Nil)	3,000 (Nil)	118·8
Yola Peasants	—	—	99·9
Gombe Standard	7,990	4,610	168·4

At Yola and Gombe, where the incidence was high compared with other stations, appreciable numbers of larvae were found in the crop from late October until the end of the season.

A sample of the crop of the cotton variety trial at Gombe, roller-ginned at Samaru, showed 95 living larvae per 10 lb. of cotton seed. In the commercial crop 28 samples from markets in Bauchi and Adamawa Provinces, saw-ginned at Gombe, contained only 10 living larvae per 10 lb. of cotton seed. The difference in these records is probably accounted for by a rather lower general infestation of pink bollworm in peasant grown cotton, and also by the ability of the saw gins to remove or kill a high proportion of larvae in the seed cotton. The efficiency of the saw gin compared with the roller gin in this respect has been demonstrated on a small scale with the machines at Samaru.

An examination of samples of cotton seed and seed cotton from seven ginneries during the period February to August 1951 confirmed previous reports of a low infestation of pink bollworm in the commercial crop.

Diapause and Emergence of Pink Bollworm during 1951-52.—Pink bollworms collected in the Samaru area towards the end of the 1951-52 season were set singly in tubes under laboratory conditions to determine the dates of pupation and emergence.

Details of the dates of collection and emergence are given in Table 7. Nearly half of the moths emerged during May and June, and over 90% by the end of July, confirming the findings given in the 1950-51 Progress Report.

TABLE 7.

EMERGENCE OF PINK BOLLWORM, 1951-52.

Date of Collection	No. Set	No Emged.	Month of Emergence									
			1951 Dec.	1952 Jan.	Feb.	Mar	Apr.	May.	Jun.	July.	Aug.	Sep.
Dec. 1-15, 1951	68	38	8	11	1	3	2	5	5	2	1	—
Dec. 16-31, 1951	85	50	—	5	1	2	3	16	13	6	4	—
Jan. 1-15, 1952	127	92	—	3	3	13	6	24	23	15	4	1
Jan. 16-31, 1952	17	6	—	—	—	—	—	4	1	1	—	—
Feb. 1-16, 1952	4	3	—	—	—	2	—	1	—	—	—	—
Totals	301	189	8	19	5	20	11	50	42	24	9	1

Other Bollworms.

Spiny and Egyptian Bollworms, Earias spp.—At Samaru the population of *Earias* was small early in the season, though some damage was caused to terminals of the cotton plants. Towards the end of the season numbers increased, reaching 3,400 per acre on the control plots of the insecticide trial early in December, and 2,000 per acre on the rotation plots in February. Losses from this bollworm at Samaru were at least as extensive as those due to red bollworm.

At other stations *Earias* was recorded in small numbers, mainly in the latter part of the season.

False Codling Moth, Argyroploce leucotreta.—This pest was rare at all stations except Gombe, where it was recorded from mid-November to January with a peak population of 1,400 per acre.

American Bollworm, Heliothis armigera.—This was either absent or rarely reported from any station during the season.

Cotton Stainer, Dysdercus superstitiosus.

The pattern of the stainer attack was similar to that recorded in previous years, the insects entering the crop in September, breeding, and leaving the crop at harvest.

At Samaru and Daudawa few stainers were recorded on the observation plots, but larger numbers were present on better grown cotton at both these stations. At Daudawa, on Stage B cotton, 4,200 adults per acre were recorded early in December, and nymphs were very common when picking was in progress.

At Kontagora and Gusau stainers were more numerous than last year, with peak populations of 6,250 and 4,500 per acre respectively. Up to 3,900 per acre were recorded at Gombe and Yola.

Mirids and Leaf Tattering.

The predominant mirid in the crop at Samaru was again *Campylomma*. Though small numbers were present at the beginning of the season, extensive immigration into cotton did not occur until the middle of September, and the peak population was recorded early in October. Details of the population build-up are given in the results of the Samaru insecticide trial.

Lygus was present in small numbers; on the insecticide trial less than 1 was caught per 100 plants swept. Other mirids in the crop included *Psallus sp.*, and *Deraeocoris sp.*, which is predatory.

Leaf tattering, coincident with the general *Campylomma* population, was common at Daudawa and Samaru, but variable in its extent. Some fields at Samaru were heavily damaged, occasional plants being rendered completely sterile, but on the whole, damage was rather less than that recorded last year.

An eye estimation of the extent of tattering on the "Soil fertility, spacing, and planting date for cotton" experiment made on 7th and 8th October 1952 confirmed previous observations. Highly significant differences were recorded between treatments, there being less tattering with wider spacing, later sowing and lower level of fertility. The reduction in damage was, however, too small to nullify the advantage in growth and fruiting obtained by early sowing and high fertility.

Miscellaneous Pests.

Examination during May of cotton plants left to stand over from the 1952-53 season revealed that about one quarter of the plants harboured larvae of *Sphenoptera gossypii,* the cotton root borer. Sampling indicated a larval population of 4,500 per acre, together with some pupae and recently emerged adults still in the roots. This pest appears to be of little importance during the growing season.

Hemitarsonemus latus caused typical early symptoms of "acariose" on one small area of poorly grown cotton at Samaru.

Other minor pests noted included *Brachytrypes membranaceus, Sylepta derogata, Agonoscelis versicolor, Oxycarenus sp., Bemisia sp.,* and *Calidea sp.*

Crop Loss.

Shedding.

At Samaru maximum shedding of buds and bolls occurred during the last two weeks of October, reaching a peak of 8,700 bolls shed per week per acre on the rotation plots. At Yola shedding was heavy throughout October, with a peak of over 19,000 bolls per week per acre. Elsewhere maximum shedding occurred during November or early December.

Table 8 summarises the results of an examination of shed buds and bolls, and split bolls, at each station.

TABLE 8.

PERCENTAGE DAMAGE BY BOLLWORMS AMONGST SHED BUDS, SHED AND ABORTED BOLLS, AND RIPE BOLLS, 1952-53.
(Figures for 1951-52 in parenthesis.)

Station	*Shed buds*	*Shed and aborted bolls*	*Ripe bolls*
Samaru (Rotation)	30·2 (62·7)	32·2 (36·7)	25·3 (44·5)
,, (Insecticide Control) ...	50·4	34·9	35·7
Daudawa Standard	30·8 (47·0)	15·9 (29·7)	20·9 (26·6)
,, (Insecticide Control) ...	44·9	20·7	38·3
Kontagora Standard	59·2 (63·3)	63·9 (59·9)	92·3 (75·2)
Gusau ,, ...	46·3 (42·2)	31·5 (41·4)	38·3 (65·5)
Yola ,, ...	52·2 (26·8)	30·3 (24·7)	70·9 (32·9)
Gombe ,, ...	39·1	29·6	47·9

Damage to Ripe Bolls.

The analysis of damage to non-shedding bolls is given in Table 9. The low proportion of clean locks recorded at Yola and Kontagora was partially due to the increased red bollworm population at these stations. The percentage of clean locks at Samaru, Gusau and Daudawa was higher than last year.

TABLE 9.

PERCENTAGE LOCK DAMAGE IN NON-SHEDDING BOLLS.
(1951-52 figures in parenthesis.)

Station	*Clean*	*Boll-worm partial loss*	*Boll-worm total loss*	*Non-boll-worm partial loss*	*Non-boll-worm total loss*
Samaru (Botanist Rotation)	75·8 (54·6)	5·1	4·4	11·7	2·9
Samaru (Insecticide Control)	68·4	8·2	8·7	11·7	2·9
Daudawa Standard	77·6 (58·7)	2·7	4·8	12·0	2·9
Daudawa (Insecticide Control)	60·3	6·0	11·1	17·2	5·3
Kontagora Standard	18·1 (25·9)	34·1	15·9	11·7	20·2
Gusau Standard	61·2 (47·3)	9·0	10·6	11·7	7·4
Gusau (Peasants)	63·0	10·1	8·0	7·1	11·8
Gombe Standard	57·9	12·8	5·7	16·8	6·8
Yola Standard	28·0 (31·9)	14·8	19·8	27·8	9·6

INSECTICIDE TRIALS.

Daudawa.

The results of insecticide trials at Samaru and Daudawa since 1949 suggest that a high concentration of DDT is desirable for the control of red bollworm. The trial at Daudawa this year was therefore designed to compare the effects of dust containing DDT at a higher concentration and dosage than that used hitherto, with the same dosage of DDT applied as an emulsion.

The treatments, which also included one based on Toxaphene emulsion, were as follows;—

A: Dust containing 10% DDT and 3% gamma BHC applied at rate of 40 lb. per acre, i.e., 4 lb. DDT per acre.

B: 1% DDT emulsion applied at rate of 40 gallons per acre, i.e., 4 lb. DDT per acre.

C: 1% Toxaphene emulsion at rate of 40 gallons per acre, i.e., 4 lb. of Toxaphene (technical product) per acre.

D: Control.

Each treatment was applied three times, the dates of application being 24th October, 14th November, and 5th December, 1952. There were eight replications of each treatment on plots of 1/40 acre. The sowing date of the cotton, which was in the experimental area, was 10th July, and five fortnightly pickings were made between 9th December 1952 and 3rd February 1953.

A summary of the results is given in Table 10.

TABLE 10.
DAUDAWA INSECTICIDE TRIAL, 1952-53.
SUMMARY OF RESULTS.
[All yields in lb. seed cotton per acre.]

	Treatments				S.E.
	A	B	C	D	
1. Bulk yields, based on 9 × 12 yards per plot	338	348	347	290	11
Percentage: Control (D) = 100%	116	120	120	100	
2. Ripe crop sample, based on 1 × 12 yards/plot.					
Yield of unsorted seed cotton (Clean, stained and rotten).	503	536	476	395	16
Percentage: Control = 100%	127	136	120	100	
Yield of clean seed cotton	449	471	388	307	14
Percentage: Control = 100%	146	153	126	100	
Percentage clean seed cotton	89	88	82	78	
3. No. of split bolls produced per plant	3·40	3·83	3·60	3·08	
% damage by B.W. amongst split bolls	20·7	22·3	31·8	38·3	
*4. Percentage lock damage in non-shedding bolls.					
Clean locks	78·3	79·8	69·2	60·3	
Bollworm partial loss	2·9	3·3	5·6	6·0	
Bollworm total loss	4·3	6·6	8·8	11·1	
Non-bollworm partial loss	10·7	9·1	13·1	17·2	
Non-bollworm total loss	3·8	1·3	3·3	5·3	
5. % of shed buds damaged by bollworms	—	26·6	—	44·9	
% of shed bolls damaged by bollworms	—	10·4	—	20·7	
*6. No. of *Diparopsis* eggs per plant, 28/10-30/1	—	1·5	—	2·2	
Diparopsis index	28	44	81	119	
Transformed $\sqrt{x} + \frac{1}{2}$	14·9	18·4	25·7	30·7	1·9
Earias index	39	44	30	51	
Transformed $\sqrt{x} + \frac{1}{2}$	17·2	19·0	16·0	20·7	1·6

*The methods used for determining lock damage and bollworm indices are given in the Progress Report for 1951-52.

Yields.—The bulk yields were determined from 9 rows of 12 yards in each plot, and are lower than the true yields because of handling effects, crop sampling, and interaction at the edges of the plots. Nevertheless, all treatments gave highly significant increases in yield compared with the control.

A more detailed picture of treatment differences is shown by the ripe crop samples, taken from 1 row of 12 yards in each plot. This row was disturbed as little as possible during the growing season. Compared with the control, all the insecticide treatments gave highly significant increases in yield, both of clean seed cotton, and of unsorted seed cotton which had not been picked over to remove stained and rotten lint.

There was no significant difference in yield between the dust and DDT emulsion, but the latter was more effective than the Toxaphene emulsion. The highest yield, equivalent to 53% more clean seed cotton than the control, followed the use of DDT emulsion.

The increase in yield of clean seed cotton was due to (a) more bolls per plant reaching maturity, and (b) a higher percentage of clean cotton produced by these bolls. With treatment B, for example, the higher crop production gave an increase of 36% in the yield of unsorted seed cotton, and this contained 13% more clean seed cotton than the control. A combination of these factors resulted in a 53% increase in yield of clean seed cotton.

Bollworm Control.—The dates of application were chosen with a view to controlling the red bollworm, and the degree of control achieved, which is reflected in the yield figures, can be gauged from the *Diparopsis* index for each treatment.

The best treatment was the DDT/gamma BHC dust which gave a reduction of 76% in the index compared with the control, but did not differ significantly from the DDT emulsion. A smaller degree of control followed the use of Toxaphene emulsion, which gave a 32% reduction in the index.

The *Earias* index shows no significant difference between treatments. *Earias* larvae were present in the crop until harvest and many were, therefore, unaffected by the treatments, the last of which was applied early in December.

Samaru.

The yields obtained in previous insecticide trials are to some extent confirmed by the figures for bollworm populations and bollworm damage, but there are some discrepancies which are difficult to explain. It was suggested in the previous report that the increased yields obtained by using insecticides were not exclusively due to control of

bollworm, but that some other pests (e.g. mirids) were also being controlled.

The experiment at Samaru was, therefore, arranged to distinguish between the effects of mirid and bollworm attack by early spraying against the former during September and early October, and late spraying against the latter during late October and November.

The four treatments, replicated 4 times using plots of nearly 1/13 acre sown on 5th July, were as follows:—

A: Early spraying of 0·5% DDT emulsion at 40 gallons per acre (2 lb. DDT per acre), applied on 8th September, 22nd September and 6th October.

B: Late spraying of 1% DDT emulsion at 40 gallons per acre (4 lb. DDT per acre), applied on 27th October, 10th November and 24th November.

C: Early and late spraying as given in treatments A and B.

D: Control.

The predominant mirid present was *Campylomma;* very few *Lygus* were swept before 16th September and none after this date.

The *Campylomma* population was estimated weekly by sweeping a 12 yard ridge in each plot three times, the total number caught being used to calculate the population swept per acre. Numbers were low on the control plots early in September, but migration increased the population to 20,000 per acre by 7th October. After this date there was a rapid fall, so that only small numbers were present after the middle of November.

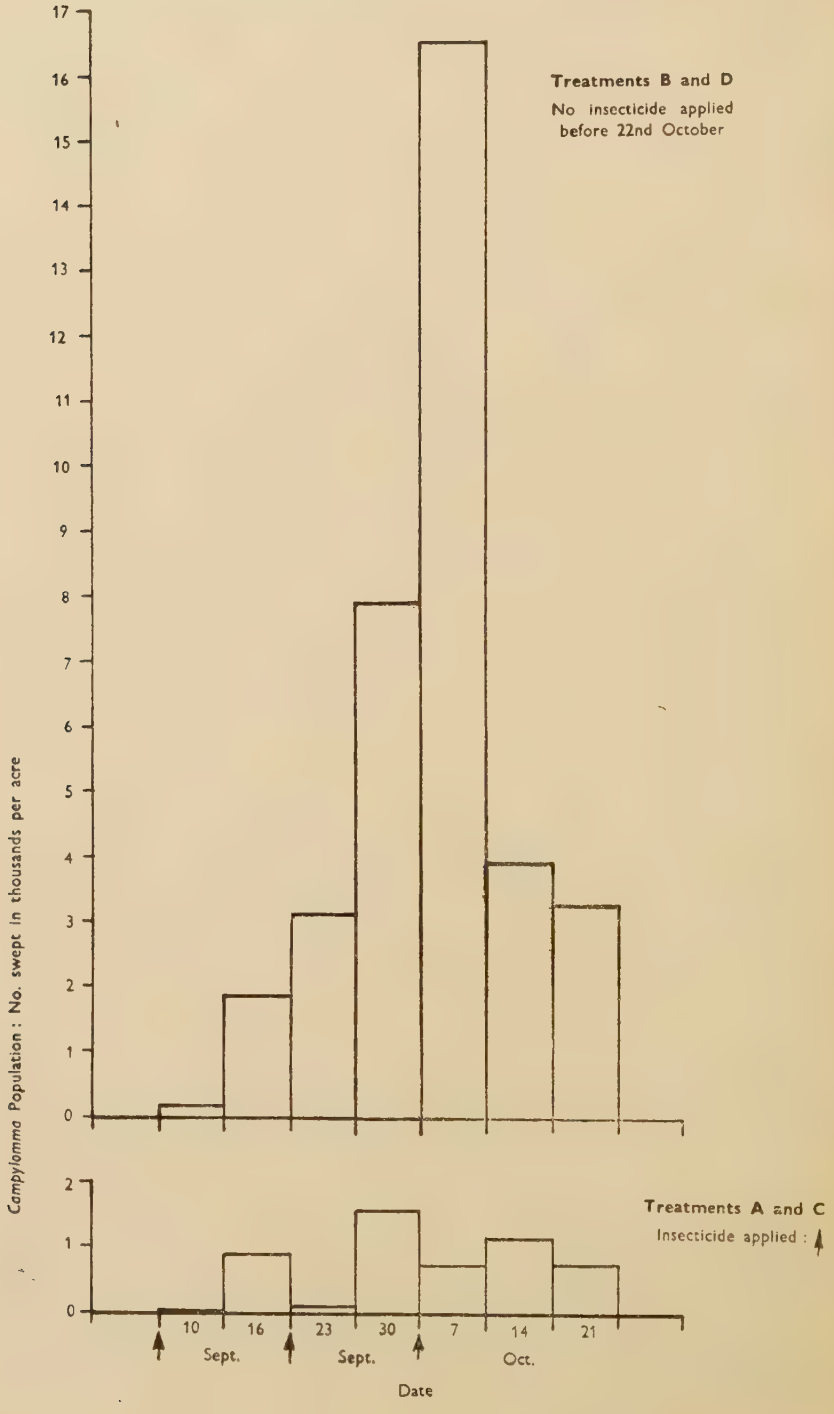
The degree of control achieved is shown in Fig. 1, which is based on a combination of the results of treatments A and C, which received early spraying, and B and D which did not. Sweeps taken the day after spraying revealed that the population was reduced to less than 5% of that on the unsprayed plots. During the two-week intervals between sprayings the population increased again at a rate similar to that on the untreated plots.

An eye estimate of the degree of leaf tattering for each treatment made on 31st October showed that control of *Campylomma* had been followed by an appreciable decrease in the visible damage to the plants.

The flowering records suggest that one result of the early spraying was an earlier peak of flowering in treatments A and C, presumably because fewer buds were lost owing to mirid feeding.

However, deductions from the observations on fruiting behaviour and yield are inconclusive owing to the wide variation in fertility within the area of the experiment. For example in treatment A, the worst plot yielded 103 lb. of seed cotton per acre, and the best, 501 lb. per acre. Final yields, based on 3 rows of 24 yards per plot, are given in Table 11.

SAMARU INSECTICIDE TRIAL—1952-53 Fig. 1



The experiment is being repeated in a different area during the 1953-54 season using larger plots and more replications; a full report on both experiments will be given in the next Progress Report.

TABLE 11.

SAMARU INSECTICIDE TRIAL, 1952-53.

YIELDS IN LB. SEED COTTON/ACRE.

Treatment	A	B	C	D
Yield	323	442	323	318
S.E.	49. Differences not significant.			

Received January 1954.

Printed by T. Buncle & Co. Ltd., Arbroath